ON THE MANUFACTURE OF IRON-WIRE ROPE FOR BRIDGES, AND FOR MINING AND OTHER PURPOSES.

By Andrew Smith, Esq.

Iron-wire possesses, in proportion to its weight and size, nearly the greatest strength of any material yet known. This strength is produced by the important change which the material undergoes in its transformation from rod into wire.

For instance, by means of alternately annealing the wire in a close retort heated by charcoal, and afterwards drawing it through a proportionate number of holes in the wire-drawing plate, the wire is reduced from about $\frac{5}{16}$ths in diameter, until it arrives at No. 16 wire-gauge, which is about $\frac{1}{16}$th of an inch in diameter, and the size mostly manufactured by Mr. Smith. The wire is then twenty-five times longer, and, by comparison, three times more tenacious, than at first; and this country fortunately possesses enough of the raw material for the supply of the whole world with iron-wire.

The wire-ropes are made of the ordinary kinds known as selvigee, hawser-laid, and cable-laid ropes; and their manufacture is much after the manner of similarly named hempen ropes, if it is considered that each hempen yarn is exchanged for a single metallic wire.

Selvigee wire-ropes are made of wires laid parallel and without twist, and covered or *served* spirally with hemp, which is prepared with an Indian-rubber solution to exclude wet.

Hawser-laid wire-ropes consist of three, four, five, six, or more strands, in which case each strand is previously twisted, and in the centre of each strand there is a hempen cord saturated with the above preparation. The strands are then laid or twisted together, and in the spaces between the several strands are placed larger saturated hempen cords, which serve to diffuse the Indian-rubber preparation throughout the wire, to preserve it from oxidation, and also to serve as a cushion for the better accommodation of the strands amongst themselves.

Cable-laid wire-ropes, which are less frequently made, consist of three or more of the ordinary hawser ropes laid together, and twisted the reverse way, as usual; larger hempen cords being interposed as in the hawser ropes.

Flat wire-ropes or bands are made of three or more small hawser ropes placed side by side, and kept in contact by a covering of hemp or wire woven around the several lines, which are alternately made with a right-hand and left-hand twist, to preserve the band flat or from curling round. The flat ropes are principally used for the whims or lifting tackle of mines.

Annexed to the original paper on the wire-rope are several

tables, of which the titles and a few extracts are given. The first table, "*Tests of the strength of single wires*," contains the breaking weight of wire from No. 10 to No. 26 gauge, as denoted by the testing machine. No. 10 wire broke with a strain of 798 lbs.; No. 16 with 210 lbs.; and No. 26 with 18 lbs. 4 oz.

The next table, the "*tests of patent wire selvigee rigging rope, and hemp-rope*," was made in 1837 by order of the Lords of the Admiralty.

The test was applied to "government hemp ropes," varying from 3 inches to 12 inches in circumference. The 3-inch rope was 4 feet $10\frac{1}{2}$ inches long, stretched $10\frac{1}{2}$ inches, and broke with $2\frac{1}{2}$ tons; the 5-inch rope was 11 feet 3 inches long, stretched 1 foot 7 inches, and broke with 5 tons; the 12-inch rope was 12 feet long, stretched 3 feet, and broke with 22 tons.

Mr. Smith's rope of "17 wire-gauge" and 3 inches in circumference, was 11 feet 1 inch long, stretched $2\frac{1}{2}$ inches, and broke with $15\frac{1}{2}$ tons.

The third table shews the "*comparative difference between patent wire selvigee rigging rope, hempen rope, and chain, as regards size, strength, weight, and price.*"

The breaking strain of wire-rope of 1 inch circumference is stated to be 1 ton, the weight per fathom 12 oz., and the price per fathom 5*d.* Hempen rope of the same strength, and 2 inches circumference, weighs 1 lb. 1 oz. per fathom, and costs $5\frac{1}{2}d.$ per fathom, and chain of equal strength, or of $\frac{1}{4}$ inch diameter, weighs 3 lbs., and costs 1*s.* 6*d.* per fathom.

The table states that the breaking strain of wire-rope of 6 inches circumference is 54 tons, weight 34 lbs., and price 18*s.* 6*d.* per fathom. Hempen rope of 15 inches circumference, and of the same strength as the 6-inch wire-rope, weighs 47 lbs. 8 oz., and costs 1*l.* 0*s.* $9\frac{1}{2}d.$ per fathom, and chain of the same strength, and $1\frac{7}{16}$ inches diameter, weighs 115 lbs., and costs 1*l.* 4*s.* per fathom.

A comparison is also made between the wire-rigging of Mr. Smith's manufacture, and the ordinary hempen rigging as proposed for the iron ship "John Garrow," the total weight of the wire-rigging for this ship being calculated at 5336 lbs. whereas that of the hempen would be 11,974 lbs.; taking the former at 60*s.* per cwt., the total cost of the wire-rigging would be 142*l.* 18*s.* 6*d.*, whereas the hemp-rigging, at 2*l.* 6*s.* per cwt., would amount to 245*l.* 17*s.* 9*d.*

Mr. Smith has also applied copper wires as lightning-conductors to ships in Her Majesty's navy, that metal being preferred from its superior facility of conducting electricity; and a similar copper wire-rope, from its pliancy, also serves for the sash-lines of windows.